JOINT DARK ENERGY MISSION
SCIENCE WORKING GROUP

STATEMENT OF TASK

June 2008

Introduction:

The *ad hoc* Joint Dark Energy Mission (JDEM) Science Working Group (SWG) is being convened by the two US agencies, the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE), which are jointly funding JDEM. The purpose of this SWG is to continue the work of the Dark Energy Task Force in developing a quantitative measure of the power of any given experiment to advance our knowledge about the nature of dark energy. The measure may be in the form of a "Figure of Merit" (FoM) or an alternative formulation. The findings of the SWG will be reported to the agencies and will be considered for incorporation into NASA's future JDEM Announcement of Opportunity (AO).

To facilitate the development of findings that would have international usage, the European Space Agency (ESA) has been asked to nominate dark energy experts for membership in the JDEM SWG as well.

Rationale:

The Dark Energy Task Force (DETF), established by the Astronomy and Astrophysics Advisory Committee (AAAC) and the High Energy Physics Advisory Panel (HEPAP) to recommend a coordinated program among NASA, DOE and the National Science Foundation (NSF) for the study of dark energy, produced their final Report in 2006 *[http://www.nsf.gov/mps/ast/aaac/dark_energy_task_force/report/detf_final_report.pdf].* This Report defined a FoM based on the values of experimental errors in the measurements of the zeroth and first time derivatives of the dark energy equation of state's coefficient *w*. The DETF recommended that a dark energy space mission must exceed a threshold FoM value for its scientific potential to justify its cost.

The DETF did an outstanding job in developing a mathematical procedure to estimate the science potential of the various techniques for exploring dark energy, and gave the community its first benchmark for evaluating the power of proposed ground- and space-based experiments. With the passage of time, however, the dark energy community (including members of the original DETF) has recognized that the DETF's original FoM may no longer be the optimum measure of the discovery power of a dark energy technique or combination of techniques. The Spring 2008 Symposium on "A Decade of Dark Energy" hosted by the Space Telescope Science Institute made clear the diversity of opinion that the community now has on this issue. [See *http://www.stsci.edu/institute/conference/spring2008/talksList* for presentations.]

To assist in the scientific evaluation of proposed JDEM missions, NASA and DOE intend to make use of the best current measures of a dark energy investigation's scientific

potential in the JDEM selection process. The role of this JDEM SWG, then, is to examine the dark energy experimental FoM as defined by the DETF, and validate it or identify a new state-of-the-art measure or measures that have no or minimal bias towards any particular technique or theory.

Lifetime of the SWG:

NASA, with coordination from DOE, intends to release a JDEM AO before the end of 2008. The two agencies therefore would like to convene a JDEM SWG as soon as possible and have it provide the agencies with its findings within one month of its formation, i.e., by approximately the beginning of August. It is expected that there will be at least two face-to-face meetings of the entire SWG, with much of its work being done at home institutions and via telecons. A brief written report is required following the verbal presentation of findings to the agencies.

Charge to the JDEM SWG:

1. Update or replace the original DETF's FoM with a new, superior measure or measures of the scientific power for advancement in our knowledge of dark energy. This measure will presumably be a function of the accuracies that any given experiment can provide for a set of parameters associated with the dark energy equation of state.
2. Determine a threshold value for this measure that any proposed JDEM investigation(s) must exceed to qualify for selection. If multiple measures are developed, provide the threshold values for each of these.
3. The SWG measure(s) should attempt to minimize the bias towards a particular methodology or dark energy theory and be useful for distinguishing among competing theories.
4. If the SWG determines that no suitably unbiased measure can be defined, provide findings on what other criteria a scientific evaluation should employ in the selection of a dark energy investigation.
5. Verbally present findings to NASA, DOE and ESA by early August. A brief written report will be due at the end of August.

The job of the JDEM SWG is to produce findings, not recommendations. The SWG may therefore provide multiple findings that reflect differing opinions within the SWG. The value of the Report, however, will scale inversely to the number of differing findings.